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| **UNIT 4** | Unit 4 Test |  |
| ASSESSMENT |  |

# Goal • Demonstrate your understanding of structures and forces.

# What to Do

Carefully read the instructions before answering each set of questions.

**Fill in the Blanks**

Complete each sentence with the correct term from below. You may only use each term once. There are extra terms that you will not use.

one litre mass spread

margin of safety warm external

joined dries layers

opposite stability internal

weight cool stick

1. A standard kilogram has about the same mass as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of milk  
   or water.
2. To limit accidents and damage, engineers design structures with a high  
   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
3. A triple beam balance is used to measure \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ forces act on the materials of a structure.
5. Building on a strong foundation and keeping thrust lines vertical are principles of the   
   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a structure.
6. Frame structures are weakest where materials are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ together.
7. A shell structure is able to resist destructive forces because the force is  
   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over the entire structure.
8. Thermosetting glue holds things together as it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, while  
   solvent-based glue holds things together as it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
9. The layers in facial tissue can be put together with the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ going in  
   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ directions to achieve greater strength.
10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ factors, such as a wind, snow loads, and ground stability, all  
    affect a designer’s choices when designing a structure.

**True/False**

Some of the following statements are false; some are true. Mark A if the statement is true, and B if the statement is false.

1. Mass structures have a low level of compressive strength.

A) True

B) False

1. A frame structure *never* has a covering over the frame itself.

A) True

B) False

1. Layered materials cannot be used in shell structures.

A) True

B) False

1. Newton proposed that the centre of gravity of a large object, such as Earth, would be in the exact centre of that object.

A) True

B) False

1. This force diagram would correctly represent a hovering spacecraft.

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A) True

B) False

1. If you kick a large building, the force of your kick has an effect on that building.

A) True

B) False

1. In order for a structure to "fail" it must collapse completely.

A) True

B) False

1. Excessive torsion forces will cause a structure to shear.

A) True

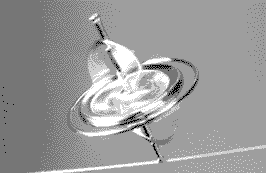
B) False

1. A bird sitting on the windowsill of your house is an example of a dead load.

A) True

B) False

1. This picture illustrates the principle of torsion.



A) True

B) False

**Multiple Choice**

Circle the option that best answers the question or completes the statement.

1. What is the one thing that all of the following have in common?

1) a snowflake

2) the Calgary Tower

3) an automobile

4) a tree

A) They are all structures.

B) They are all natural structures.

C) They are all manufactured structures.

D) They are all patterned structures.

1. What is the name used to describe something that could change the shape, size, or position of a structure?

A) impact

B) load

C) mass

D) force

1. Which of the following would be an aesthetic consideration for a tennis racket?

A) colour

B) shape

C) symmetry

D) logo design

E) all of the above

1. Lucy, an architect with a Calgary firm, is responsible for designing a new public library. She has been told what the function will be and she knows the safety regulations. As well as function and safety, she wants the building to be beautiful. What is another word for "looking good" in structure design?

A) balanced

B) composition

C) symmetry

D) aesthetics

1. Mass and weight are often confused with each other, but there is a definite difference. How would this difference best be described?

A) Mass is the amount of gravity acting on an object, and weight is the amount of material the object is made up of.

B) Mass is dependent on the distance between two or more objects, and weight is always constant.

C) Mass is dependent on the volume of an object, and weight is always constant.

D) Mass measures the amount of matter an object is made of, and weight measures the force of gravity on the object.

1. Which of the following would be an acceptable way to design a tennis racket?

A) Work without a plan and decide what to do as you go along.

B) Design the racket to use whatever materials you have available.

C) Develop a partial plan and make required changes after making the racket.

D) Create a detailed plan based on in-depth research of materials and design specifications.

E) Copy an existing design.

1. Rectangular frames can be pushed out of shape by forces acting on them. Which of the following devices would *not* be used to help stabilize these frames?

A) brace

B) tie

C) gusset

D) corrugated layers

E) B and D

1. You are hired by a contractor to help frame a house. On your first day, you want to impress everyone with your understanding of design. You tell the contractor that frames that are weak in the middle can be stabilized by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

A) bracing the middle of the beam

B) supporting the load by an arch

C) adding a cantilever

D) A, B, and C

1. Why is the Leaning Tower of Pisa tipping?

A) The weight of the structure is causing the soil on one side to compress and slip sideways.

B) One side of the tower is heavier than the other side.

C) The foundation hole was dug unevenly.

D) Water drained into one side of the base.

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**Matching**

Match the words in column A with the descriptions in column B. Write the letter of the best response in the appropriate blank beside column B. Items in column A may be used more than once or not at all.

**A B**

a) tension \_\_\_\_\_\_\_crushes material by squeezing it together

b) compression \_\_\_\_\_\_\_stretches material by pulling its ends apart

c) shear \_\_\_\_\_\_\_bicycle spokes experience this type of force

d) torsion \_\_\_\_\_\_\_bends or tears material by pushing it in

opposite directions at the same time

\_\_\_\_\_\_\_doorknobs are designed to withstand this

kind of force

**A B**

a) force meter \_\_\_\_\_\_\_ the force required to move a stationary

b) balance scale object

\_\_\_\_\_\_\_ the amount of mass in a standard building

brick

\_\_\_\_\_\_\_ the amount of mass held by a string before

before it breaks

\_\_\_\_\_\_\_ the force of gravity on an apple

\_\_\_\_\_\_\_ the mass of a prize-winning pumpkin

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**Short Answer**

Answer the following questions in the spaces provided.

1. Draw a diagram that shows the forces operating on a bent ruler.
2. Name two **types** of structures. Give a natural and a manufactured example for each  
   structure.  
   (a)   
   (b)
3. List four things that must be considered when designing a structure.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Give an example of

(a) a layered material \_\_\_\_\_\_\_\_\_\_\_\_

1. a composite \_\_\_\_\_\_\_\_\_\_\_\_
2. a woven or knit material \_\_\_\_\_\_\_\_\_\_\_\_
3. List three types of fasteners.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. List two ways to stabilize a structure.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Describe one possible cause of metal fatigue.

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1. What is the difference between a mobile joint and a rigid joint?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_